

# RBCA FACT SHEET

## APPLICATION OF RISK-BASED CORRECTIVE ACTION (RBCA) PROCEDURES IN WISCONSIN

*Publication of ASTM Standard E-1739 "Guide to Risk-Based Corrective Action (RBCA) at Petroleum Release Sites" (December 1995) has contributed to increased interest in use of RBCA planning procedures nationwide. In Wisconsin, risk-based corrective action procedures designed to protect public health and the environment are detailed in Chapters NR 140 and NR 700-726 of the Wisconsin Administrative Code. These rules set forth systematic procedures for management of environmental discharges which, although different from the ASTM RBCA process, address the same risk management objectives targeted by the ASTM Guide. In addition, these rules provide flexibility for use of key elements of the ASTM RBCA planning process.*

*This Fact Sheet provides a brief overview of the Wisconsin corrective action process and identifies opportunities for application of the risk management elements of the ASTM RBCA process.*

### OVERVIEW OF ASTM RBCA PROCEDURES

As embodied in ASTM E-1739 and the accompanying guidance manuals (see References 1-3), the ASTM RBCA process seeks to integrate risk assessment practices with traditional site investigation and remedy selection activities. The ultimate goal of the RBCA planning process is the closure of sites in a protective and cost-effective manner.

Under this integrated approach, sites are characterized in terms of sources, transport mechanisms, and receptors (see Figure 1). Remedial measures are then applied as needed to prevent human or environmental exposure to harmful levels of site constituents. Such risk-based corrective action can be achieved by addressing any step in the exposure process: i) removing or treating the source, ii) interrupting contaminant transport mechanisms, or iii) controlling activities at the point of exposure. Key elements of the ASTM RBCA planning process are as follows:

#### **Site Prioritization and Immediate Response:**

Under the ASTM program, sites are first classified with regard to the magnitude and immediacy of potential human health and environmental risks, and appropriate emergency response actions are implemented as needed. The goal of this preliminary classification/response step is to target available remediation resources toward those sites posing the greatest risk in the immediate future.

#### **Tiered Evaluation of Cleanup Objectives:**

Per the ASTM process, soil and groundwater cleanup standards are calculated as site-specific limits based upon the estimated degree of

risk posed to human health or the environment. For purpose of efficiency, calculation of risk-based cleanup standards proceeds in a tiered manner, designed to match the level of effort to the relative complexity of each site. The tiered process begins with a direct comparison of site constituent concentrations to generic screening levels (Tier 1) and, if desired by the responsible party, proceeds to more involved, site specific calculations under Tier 2 (simple fate-and-transport analyses) or Tier 3 (complex fate-and-transport analyses). The sequential tiers serve to refine the cleanup standard evaluation, based on increasingly sophisticated levels of data collection and analysis. Upon completion of each tier, the user reviews the results and decides if further analysis is required to establish appropriate and cost-effective remediation goals.

#### **Risk-Based Remedy Selection:**

Under RBCA, remedial actions are required for all areas of affected soil and groundwater containing site constituents in excess of applicable risk-based limits. The goal of the remedial action program is to reduce the potential for human or ecological exposure to these constituents at levels causing harmful effects. This can be achieved by either removing or treating the source materials; controlling contaminant migration pathways; interrupting possible exposure routes; or some combination thereof. Flexibility in the development of risk-based remedial action strategies is considered central to the overall efficiency and economy of the risk management program.

Detailed information regarding the ASTM RBCA process can be found in References 1-3. Guidelines for use of

ASTM RBCA procedures under Wisconsin DNR regulations are described in further detail below.

### USE OF RBCA UNDER WISCONSIN RULES

The Wisconsin corrective action rules and the ASTM RBCA process share the objective of protecting public health and the environment in a cost-effective manner. Each of the key elements of the ASTM process, as described above, are either incorporated in the current Wisconsin rules or can be employed on a case-by-case basis to expedite the site remediation/closure effort.

Requirements for investigation and remediation of environment discharges are specified in Chapter NR 700-726 of the Wisconsin Administrative Code. Related groundwater standards are specified in Chapter NR 140. A simplified version of this corrective action program is shown on Figure 2. As shown, the current Wisconsin corrective action program involves a systematic process for management of environmental discharges from the time of discovery until final site closure. Soil and groundwater cleanup standards mandated under these rules are risk-based, with consideration of site-specific conditions. As itemized on Table 1, several amendments to the Wisconsin regulations,

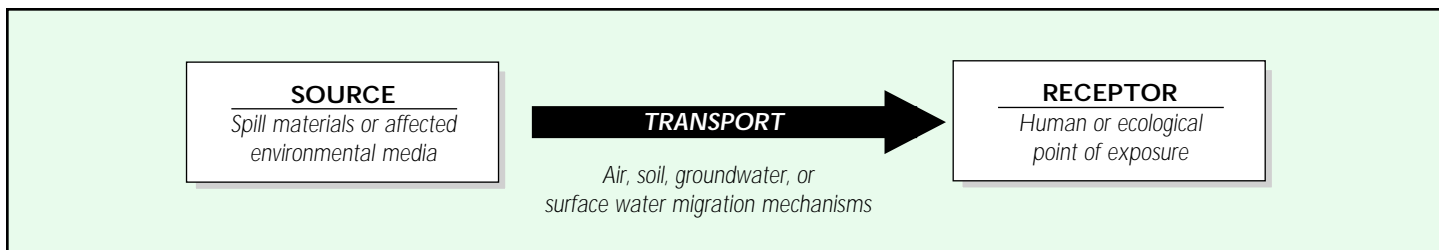


Figure 1. Conceptual Exposure Model

designed to provide greater flexibility for use of natural attenuation remedies, are presently under development. Principal steps of the Wisconsin corrective action process, including opportunities for use of ASTM RBCA procedures, are discussed below.

### 1) Immediate and Interim Actions (NR 708)

Comparable to the ASTM RBCA process, the Wisconsin corrective action program requires immediate abatement actions for environmental releases posing an immediate threat to public health, safety, or the environment. Interim actions may also be required at the early stages of response to stabilize the release or minimize the spread of free product.

**Use of ASTM RBCA Procedures:** The ASTM site classification system provides prescribed response actions for each site classification scenario (see References 1 and 2). Many of these prescribed response actions may prove to be appropriate abatement measures under NR 708 (e.g., source containment, vapor control, etc.)

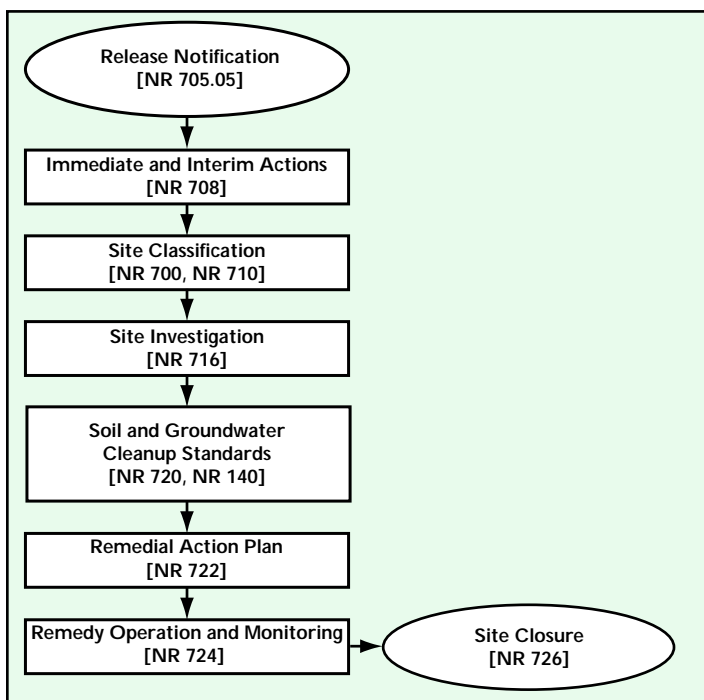


Figure 2. Wisconsin Corrective Action Program (NR 140 and NR 700 Series)

### 2) Site Classification (NR 710)

Under NR 710, sites are classified as high, medium, or low priority based on the relative threat to public health or the environment. A corrective action site qualifies as high priority if groundwater beneath the site contains substances of a public health concern at levels exceeding applicable enforcement standards. Leaking underground storage tank (LUST) sites may be further classified within each category using the LUST site scoring worksheet. Although these classification systems are intended for internal use by the DNR, responsible parties may also propose prioritization of response actions for multiple sites based on DNR rankings or other acceptable site classification systems.

**Use of ASTM RBCA Procedures:** For owners of multiple corrective action sites, the ASTM RBCA site classification system may prove a useful tool for strategic scheduling of site remediation/closure efforts so as to first address near-term, high-risk sites. Such management plans may be proposed for consideration by the DNR on a case-by-case basis. If approved, the management plan would be authorized by a Consent Agreement.

### 3) Site Investigation (NR 716)

For sites where soils and/or groundwater have been affected by the environmental discharge, a field and laboratory investigation must be implemented to define the full extent of soil and groundwater containing constituents in excess of applicable remediation standards. Site investigation protocols are described under NR 716 and relevant DNR guidance documents. In addition to delineation of affected media, the site investigation must provide sufficient data to characterize the potential rate and direction of constituent migration and to assess the feasibility of possible remedial measures, including natural attenuation. Based on the results of these investigations, LUST sites found to have had no impact on groundwater quality will be transferred to the Department of Commerce for oversight of any necessary corrective actions. Sites impacting groundwater will remain under DNR oversight.

**Use of ASTM RBCA Procedures:** The RBCA Tier 1 and Tier 2 guidance manuals (see References 2 and 3) outline the site-specific data needs for each tier of the RBCA evaluation process. These guidelines can be used in conjunction with NR 716 and DNR technical guidance to accommodate cost-effective planning and execution of the site investigation effort.

### 4) Soil and Groundwater Cleanup Standards (NR 720, NR 140)

Soil and groundwater remediation standards applicable to a release of hazardous substances to the environment are defined under Sections NR 720 and NR 140, respectively. Exceedance of either a soil or groundwater remediation standard will trigger the requirement for a remedial action options study.

**Use of ASTM RBCA Procedures:** The ASTM RBCA Tier 2 and Tier 3 procedures could prove helpful in the development of soil and groundwater response actions in the following cases:

- i) **NR 140 Groundwater Standards:** Under NR 140, two levels of groundwater standards are applied, termed Enforcement Standards and Preventive Action Limits (see NR 140.10, Table 1). Enforcement Standards (ES) are related to existing regulatory limits, such as federal drinking water standards. The Preventive Action Limit (PAL) is expressed as a percentage (e.g., 10 - 50%) of the ES value, based on the toxic, carcinogenic, and teratogenic properties of each constituent. Once a remedial action requirement has been triggered by an ES exceedance, the PAL concentrations will represent the groundwater cleanup goals, unless certain exemptions are applied per NR 140.28. Under Chapter 160 of the Wisconsin Statutes, the NR 140 limits are mandated as protective standards for all subsurface waters. Consequently, RBCA Tier 2 or 3 procedures can be applied to develop site-specific groundwater standards only if NR 140 limits are found to be non-protective per NR 722.11.

| ADMINISTRATIVE<br>CODE SECTION | PROPOSED MODIFICATION   | STATUS                                       |
|--------------------------------|---|--|
| NR 140                         | <i>Remediation by Natural Attenuation:</i><br>Explicitly identifies natural attenuation as an appropriate groundwater remediation measure.  | Expected<br>Fall 1996                        |
| NR 720                         | <i>Generic Soil RCLs:</i><br>Expands list of chemicals for which generic Residual Contaminant Levels are provided.  | Draft issued<br>July 1996                    |
| NR 724                         | <i>Performance Evaluation Guidelines:</i><br>Establishes criteria for evaluating the effectiveness of an operating remediation system, including routine data evaluation and reporting requirements.  | Expected<br>Fall 1996                        |
| NR 726                         | <i>Natural Attenuation Site Closure:</i><br>Allows for site closure when groundwater concentrations exceed NR 140 enforcement standards if: i) plume is on-site and is diminishing due to natural attenuation and ii) on-site groundwater use restriction recorded. | Expected<br>Fall 1996                        |
| NR 728                         | <i>Deed Affidavit:</i><br>Allows deed affidavit to be filed for low- to medium-priority sites, in lieu of immediate remedial action.  | Effective<br>March 1996,<br>for 1-year trial |

Table 1: Proposed Amendments to Wisconsin Corrective Action Rules

- ii) **Generic and Site-Specific Soil Standards:** Under NR 720, soil remediation standards are derived on the basis of a) protection of groundwater resources to PAL levels and b) prevention of health impacts associated with direct contact with soils (e.g., via inhalation, dust ingestion, etc.). For gasoline-range and diesel-range organics, the responsible party may apply the *generic* residual contaminant levels (RCLs) listed on Tables 1 and 2 of NR 720 or calculated per NR 720.09(3)(b), subject to conditions outlined in NR 720.09(4)(a) and NR 720.11(2). Alternatively, *site-specific* soil RCLs are calculated per the specifications of NR 720.19. The responsible party may use RBCA modeling procedures (or other modeling methods) in conjunction with the default assumptions listed in NR 720.19(4)-(5) or may propose use of alternate exposure assumptions. Such proposals are addressed on a case-by-case basis by the DNR.
- iii) **Soil Performance Standards:** Under NR 720.19(2), as an alternative to removal/treatment of affected soils to meet applicable RCLs, the responsible party may elect to implement long-term engineering controls. Such measures are subject to a *performance standard*, a demonstration that the response action successfully achieves applicable public health and environmental protection goals. The streamlined procedures outlined for calculation of risk-based target levels under RBCA could provide a useful basis for development and monitoring of such risk management technologies. For example, for design of soil covers or physical barrier walls (used for containment of soil vapors or groundwater plumes, respectively), the RBCA Tier 2 modeling procedures can be used to define maximum allowable constituent concentrations outside the barrier system, as needed to protect possible downstream receptors. Such concentration limits can serve as design basis criteria, as well as "action levels" for monitoring of actual system performance.
- i) **Remedy Selection and Evaluation:** Prior to implementation, remedial measures must be shown to conform with the technical and economic evaluation criteria of NR 722. Available data must be evaluated to assess the need for an active engineered remedy in lieu of remediation by natural attenuation. The remedy selection guidelines outlined in the Tier 2 RBCA Guidance Manual (see Reference 3) may be used to identify applicable technologies and establish site-specific design criteria under the Wisconsin program.
- ii) **Evaluation of Natural Attenuation Remedies:** Under appropriate conditions, a natural attenuation remedy may be implemented in conjunction with a groundwater use restriction as a permanent risk management measure. For planning purposes, the Site-Specific Target Levels (SSTLs) developed per a RBCA Tier 2 or 3 evaluation may be used to assess the suitability of a site for remediation by natural attenuation processes alone. Specifically, if source zone soil and groundwater constituent concentrations do not exceed relevant SSTLs, natural attenuation controls may suffice for site remediation. If SSTLs are exceeded, an active engineered remedy may be required to reduce source media concentration to levels amenable to natural attenuation. Ultimately, the actual performance of the natural attenuation remedy must be established on the basis of site monitoring data, rather than predictive models. Nevertheless, the streamlined modeling procedures outlined under RBCA Tier 2 (see Reference 3) can serve as a useful screening tool.
- iii) **Site-Specific Risk Evaluation:** Under NR 722.11, the responsible party may request authorization for a site-specific risk evaluation if a) soil and groundwater remediation standards specified under NR 720 and NR 140 are deemed non-protective or b) soil remediation to NR 720 RCLs is technically impracticable. Under current DNR policy, approval of such site-specific evaluations is generally reserved for large, complex sites requiring detailed analysis. In such case, following agency authorization, a RBCA Tier 2 or Tier 3 evaluation could be used to develop an appropriate risk management strategy.

#### 5) Remedial Action Plan (NR 722)

Following determination of the applicable cleanup standards, remedial measures must be evaluated to identify a technically feasible and cost-effective alternative for achieving the site remediation goal. Under NR 722, active engineered remedies may involve source removal/treatment, long-term engineering controls (capping, containment, etc.), or some combination thereof. Several forthcoming modifications to the Wisconsin rules are intended to encourage the appropriate use of passive remedial measures, such as natural attenuation (see Table 1).

**Use of ASTM RBCA Procedures:** The ASTM RBCA guidelines could prove useful for remedy selection and evaluation in the following cases:

#### 6) Remedy Operation and Monitoring (NR 724)

The responsible party may employ various modeling procedures for selection and design of a site remediation system. However, the performance and completion of the remedial action effort must be demonstrated on the basis of actual site measurements. Site monitoring requirements are specified under NR 724, with additional information provided in related DNR guidance documents. Upcoming amend-

ments to NR 724 will require the effectiveness of the remedial action system to be evaluated semiannually throughout the period of operation. Following completion of the remedial action program, the duration of monitoring required to verify compliance with applicable remediation goals is determined on a site-specific basis.

**Use of ASTM RBCA Procedures:** Useful guidelines for design of compliance monitoring programs for various remedial measures (e.g., removal/treatment, containment, natural attenuation, etc.) and within various environmental media (air, soil, groundwater) are provided in the RBCA Tier 2 Guidance Manual (see Reference 3). As noted above, the RBCA modeling procedures may also prove useful for establishing performance criteria (or action levels) for monitoring of containment and natural attenuation remedies.

#### 7) Site Closure (NR 726)

The responsible party may apply for site closure once monitoring data confirm that applicable remediation goals have been achieved. If site constituent concentrations are below applicable NR 140 groundwater standards and NR 720 soil RCLs, the DNR can issue a "no further action letter", imposing no restrictions on future land use. Closure of sites exceeding soil RCL values may be authorized subject to an approved soil performance standard (NR 720.19(2)) or a site-specific risk evaluation (NR 722.11), in conjunction with appropriate land use controls. Under the proposed "closure flexibility" initiative (NR 726.05), closure of sites exceeding NR 140 groundwater standards may be allowed if: a) adequate source control measures have been implemented, b) NR 140 standards are not exceeded off-site, c) natural attenuation processes have been shown to be reducing plume concentrations such that NR 140 standards will be achieved on-site within a reasonable time period, and d) a groundwater use restriction is placed on the property deed. Technical guidelines for demonstration of natural attenuation of soil and groundwater contaminants are under development by the DNR.

## SUMMARY

Applicability of ASTM RBCA planning procedures under the Wisconsin corrective action program is summarized on Table 2. Please note that, although RBCA Tier 2 or Tier 3 modeling procedures may be employed to develop soil performance standards or evaluate the feasibility of groundwater remediation by natural attenuation, the actual effectiveness of these remedial measures must be demonstrated on the basis of site measurements. However, when properly integrated with the principal steps of the Wisconsin corrective action program, the various planning tools provided in the ASTM and RBCA guidance manuals and the related DNR technical guidance documents can serve to expedite the site remediation/closure effort.

## REFERENCES

1. American Society for Testing and Materials, 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. ASTM E-1739. Philadelphia, PA.
2. DeVaul, G.E., R.A. Ettinger, E. Hansen, R. MacDonald, C. Stanley, P. Johnson, J. Connor, and P. Nevin. January 1996. Tier 1 Guidance Manual for Risk-Based Corrective Action and Overview of the Process. Shell Oil Company, Houston, TX.
3. Connor, J.A., J.P. Nevin, M. Malander, C. Stanley, and G. DeVaul. 1995. Tier 2 Guidance Manual for Risk-Based Corrective Action. Groundwater Services, Inc. Houston, TX.

To order these publications, contact ASTM at (610) 832-9585.

**For more information regarding the Wisconsin corrective action process, please contact us at:**  
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| WISCONSIN CORRECTIVE ACTION PROCESS STEP                   | USE OF ASTM RBCA PROCEDURES   |
|--|---|
| 1) Immediate and Interim Response Actions (NR 708)         | <i>Emergency Response Measures:</i> Identify appropriate abatement measures based on RBCA site classification/response scenarios.   |
| 2) Site Classification (NR 710)                            | <i>Strategic Management Plan:</i> Develop strategic schedule for management of multiple remediation sites based on RBCA site classification system.   |
| 3) Site Investigation (NR 716)                             | <i>Site Data Requirements:</i> Identify key information requirements for site characterization and remedy selection per specifications provided in RBCA guidance documents.   |
| 4) Soil and Groundwater Cleanup Standards (NR 720, NR 140) | <i>Site-Specific Soil RCLs:</i> Use RBCA modeling methods to develop site-specific limits for groundwater protection and direct contact exposure pathways, subject to DNR approval.<br><br><i>Soil Performance Standards:</i> Use RBCA Tier 2 or 3 modeling methods to develop and monitor engineering control measures under soil performance standard (NR 720.19).  |
| 5) Remedial Action Plan (NR 722)                           | <i>Remedy Selection:</i> Use guidelines provided in Tier 2 RBCA guidance document for evaluation of risk management options and related design criteria.<br><br><i>Evaluation of Natural Attenuation Remedies:</i> For planning purposes, assess feasibility of remediation by natural attenuation using RBCA Tier 2 or 3 modeling procedures.<br><br><i>Site-Specific Risk Evaluations:</i> For sites meeting criteria of 722.11, develop site-specific, risk-based cleanup levels based on Tier 2 or Tier 3 evaluation methods. |
| 6) Remedy Operation and Monitoring (NR 724)                | <i>Compliance Monitoring Programs:</i> Use guidelines provided in RBCA Tier 2 guidance document for design of compliance monitoring program. Develop monitoring "action levels" using Tier 2 or Tier 3 modeling procedures.   |

Table 2: Use of ASTM RBCA procedure under Wisconsin NR 140 and NR 700 Series Rules